

Montana Weather/Precipitation Summary

December 2016 NOAA's National Weather Service Great Falls Montana

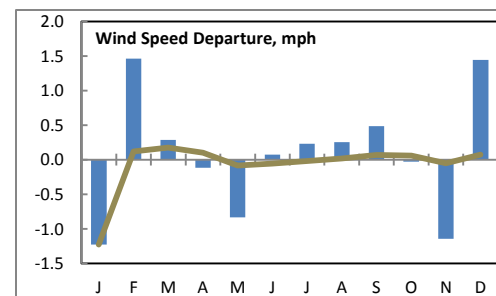
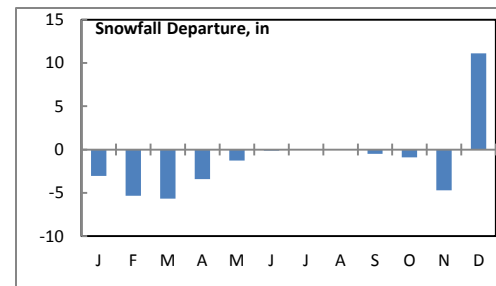
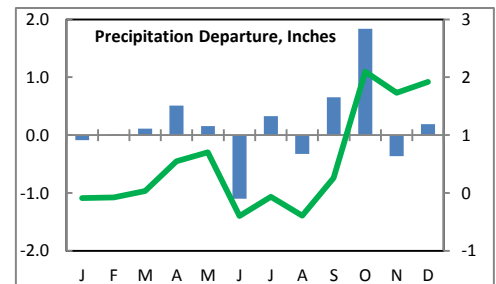
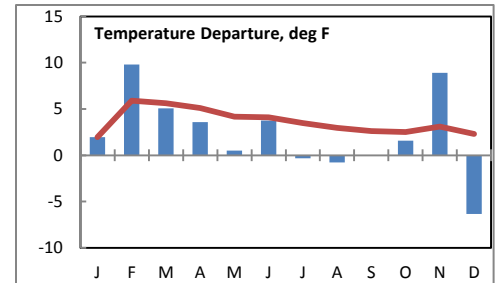
A broad trough of low pressure aloft dominated Montana's weather during December (Fig. 1), bringing northwesterly flow. This pattern brought below normal temperatures and above normal precipitation to the state. December's winds were near to much above normal.

Statewide composite temperatures averaged much below normal for the month. The red line on the graph to the right shows the cumulative 12-month departure from normal. The temperature anomalies ranged from -2.3°F at Creston to -12.0°F at Sun River (Fig. 2). The warmest average monthly temperature was 25.3°F at Thompson Falls and Norris, and the coolest was 5.9°F at Porphory Peak RAWS (Meagher). This was the 11th coolest December of record. For the past 12-months, the statewide composite average temperature is 2.3°F above normal. Nine of the last 12 months have had warmer than normal temperatures. The month's high temperature of 52°F was the coolest maximum temperature in the state since 1978.

The monthly departure from normal for precipitation across Montana is shown in Figure 3. The wettest areas were in western Montana. The highest precipitation amount recorded was 11.40-inches at North Fork Jocko (Garnett Mtns). Elsewhere, 3.89" was reported at West Yellowstone. Statewide, this month averaged 1.01", or 0.19" above normal. The statewide composite precipitation for the past 12 months is 1.92" above normal. The green line on the graph to the right shows the cumulative 12-month departure from normal. Seven of the past 12 months have measured above normal precipitation.

Above normal snow fell over much of the state. The statewide average was almost a foot above normal. Billings measured over 30", Kalispell had 33", Helena had almost 2-feet and Livingston had 28". Note how every month of the year had below normal snowfall, except December.

The statewide average winds were stronger than normal in December. Glasgow, Glendive and Sidney recorded their windiest December's of record. It was second windiest at Wolf Point, Jordan and Havre. Statewide, the month ranked as the 18th windiest December of record. The statewide composite average was 10.4 mph, 1.4-mph below normal. The brown line of the wind graph to the right shows the 12-month cumulative statewide wind departure from normal. The 12-month average is running 0.1-mph above average. Seven of the past 12 months have had above normal average speeds. The fastest average speed was 20.8 mph at Deep Creek RAWS (Glacier). At lower elevations, the strongest average was 19.6 mph at a location in the upper Madison River Valley. The strongest wind gust was 86 mph at Deep Creek RAWS on the 19th. Several locations across central Montana recorded gusts to 83 mph on the same day.



Refer to NEIC's State of the Climate report for the latest monthly discussion:

<http://www.ncdc.noaa.gov/sotc/>

Dec 1-4

The warm conditions of November lasted through the first 4 days of December. Some snow accompanied a weather system on the 1st and 2nd, then the stronger cold front moved through the state on the afternoon of the 4th.

Dec 5-18

A very cold period prevailed across much of the state for this two-week period. Much of north central and eastern Montana did not see temperatures above freezing for this entire period. The coldest period produced temperature departures as much as 37°F below normal. This was the longest, coldest period since February 1996. Temperatures bottomed out at -48°F at Elk Park on December 17, which was the coldest temperature in the state since February 2014, and the coldest December temperature since 2013. While it was cold, periods of snow affected western and southern Montana. Kalispell and Missoula picked up over 17-inches of snow during this period, while Billings measured two-feet. The heaviest snow was over the 15th and 16th, when 20-inches fell at Billings.

Dec 19-31

Strong winds accompanied warmer air on the 19th. As temperatures moved above freezing, winds gusted to over 80 mph at several locations along the Rocky Mountain Front and in central Montana (see wind gust table below). After a warm and windy period through the 23rd, temperatures returned to below normal values. A strong winter storm spread across the state for the Christmas weekend. Blizzard conditions prevailed over far eastern Montana while cold air poured back into the state. Roads became impassable with the strong winds and snowfall. A return to warmer conditions began on the 27th. This continued, along with windy conditions, through the end of the month.

Dec 19 wind gusts

Wind Gust (mph)	Location
86	Deep Creek RAWS (Glacier)
83	Livingston airport (Park)
83	South of Malta (Phillips)
83	South of Stanford (Judith Basin)
83	Browning MDT (Glacier)
80	Wicked Creek RAWS (Park)
79	Dellwo (Teton)
79	Sweet Grass MDT (Toole)
78	Goldstone (Hill)
76	East Livingston MDT (Park)
74	North of Chester (Liberty)
74	Judith Peak (Fergus)
74	Big Timber airport
74	Nye (Stillwater)
73	Bridger Bowl – Slushman (Gallatin)
73	Near Geraldine (Chouteau)
72	Norris Hill MDT (Madison)
72	Absarokee (Stillwater)
71	Near Fort Benton (Chouteau)
70	Sunburst MDT (Toole)
69	Big Sky – Lone Mountain (Madison)
69	Two Medicine Bridge (Glacier)
68	Bowmans Corner (Lewis and Clark)
67	Denton (Fergus)
67	Grass Range (Fergus)
69	Stanford (Judith Basin)
67	Babb (Glacier)
67	Power (Teton)
67	Near Raynesford (Cascade)
67	Cut Bank near (Glacier)
66	Malmstrom AFB (Cascade)
66	Bridger Bowl – Base (Gallatin)
66	Near Simms (Lewis and Clark)
65	Ennis town (Madison)

Precipitation/convection

Severe convective weather occurred on 0 days in December, which is normal.

2016 annual summary

The composite statewide average temperature for the year was 45.5°F (2.2°F above normal). This was the 10th warmest of record.

The composite precipitation for 2016 was 17.10", or 1.92" above normal. September and October were particularly wet. This was the 25th wettest year of record, and the wettest since 2014.

Composite snowfall was 40.4". This was 13.9" below normal and the lightest fall snowfall since 2004. The year ranked as the 27th lowest annual snow amount.

For winds, the average state wind speed was 9.1-mph, 0.1-mph above normal. This was the 31st calmest year of record, but the windiest since 2000.

December summary information:

High Temperature	52°F at Loma & Fort Benton (22 nd)	Greatest Precip	9.08" at Greenough 2NNE
Low Temperature	-48°F at Elk Park (17 th)		11.40" at North Fork Jocko (Powell)
Warmest Ave Temp	25.3°F at Thompson Falls and Norris	Peak Wind Gust	86 mph at Deep Creek RAWS (19 th)
Coollest Ave Temp	5.9°F at Porphory Peak RAWS		83 mph near Livingston, Browning & Stanford (19 th)
Range of Temp departures	-2.3°F at Creston to -12.0° at Sun River	Highest Ave Wind	19.6 mph in upper Madison V 20.8 mph at Deep Creek RAWS
21 city mean monthly Temperature/Normal	14.0/20.3F normal. 11 th coolest of record (since 1880). 10 th percentile. Jan-Dec 45.5/43.3 2.2F above normal. 10 th warmest of record.	20 city mean monthly wind speed/Normal	10.4 mph/9.0 mph; 18 th windiest of record (since 1936). 77 th percentile. Jan-Dec 9.1 mph/8.9 0.1-mph above normal. 31 st calmest of record.
22 city mean monthly precipitation/Normal	1.01"/0.82" – 123% of normal. 38 th wettest of record (since 1880). 73 rd percentile. Jan-Dec 17.10"/14.42" - 1.92" above normal. 25 th wettest of record.		

**Historical Rank of Precipitation (inches)
for the Current Month and Water Year to Date**

Location	Dec	% of Norm	Rank	Pcntl	Oct 1 – Dec 31	% of norm	Rank	Pcntl	Years
Baker	0.03	13%			0.99	50%			19
Billings	1.67	249%	6	4	5.56	207%	2	1	116
Belgrade	0.46	90%	34	42	3.33	140%	15	18	80
Butte	0.44	86%	49	39	3.22	170%	16	12	123
Cut Bank	1.00	500%	9	7	2.33	233%	9	7	110
Dillon	0.30	115%	19	24	2.79	208%	3	3	77
Glasgow	0.36	90%	48	40	3.53	228%	4	3	119
Great Falls	0.89	162%	33	26	2.93	147%	21	16	125
Havre	0.47	118%	45	32	3.99	283%	3	1	137
Helena	1.28	320%	10	7	2.98	190%	18	12	138
Jordan	0.32	110%	8	37	3.21	204%	3	11	20
Kalispell	1.75	112%	37	30	7.23	181%	6	4	123
Lewistown	0.33	50%	68	56	4.40	176%	7	5	121
Livingston	1.59	306%	4	3	5.16	218%	3	2	114
Miles City	0.12	41%	65	46	1.09	68%	92	65	140
Missoula	1.47	144%	34	24	4.64	156%	18	13	137
Mullan Pass	2.50	56%	65	84	17.83	144%	17	21	77
Wolf Point	0.31	103%			1.87	125%			19
Glendive	0.87	229%	11	8	1.88	99%	43	36	119
Sidney	0.88	169%	73	95	1.69	78%	39	50	77
BZN-MSU	1.36	146%	21	15	5.89	153%	7	4	138

Rankings and Percentiles are 1=driest, higher numbers=wetter.

For an automated version of this chart, updated daily, go to

<http://www.wrh.noaa.gov/tfx/dx.php?wfo=tfx&type=&loc=products&fx=PCPNTOTALS>

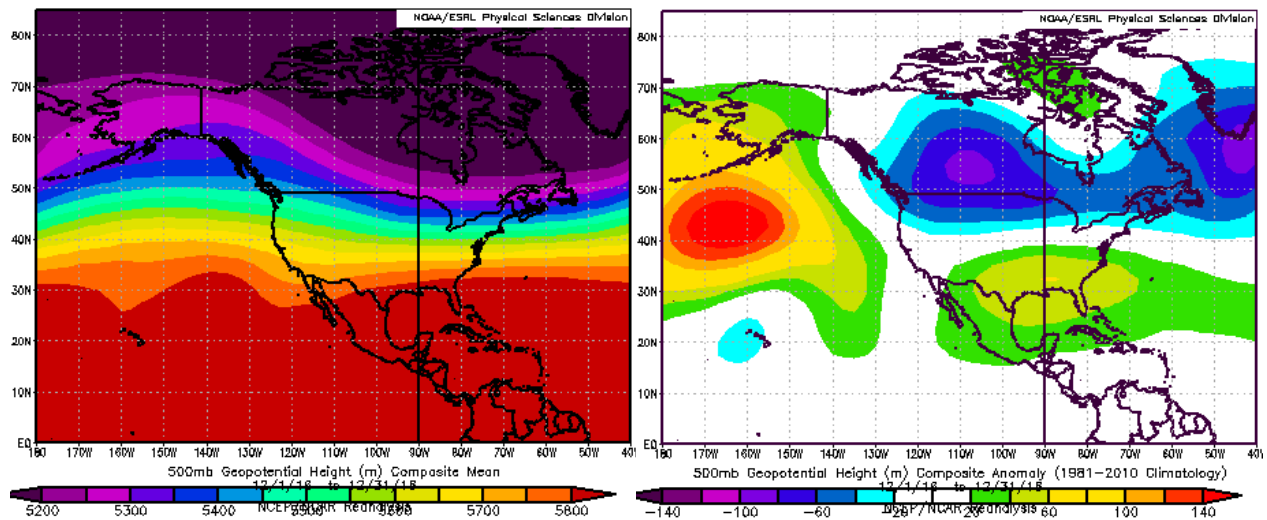


Figure 1. Mean flow at 500 millibars (~18,000 ft) for this month (left) and departure from normal (right).

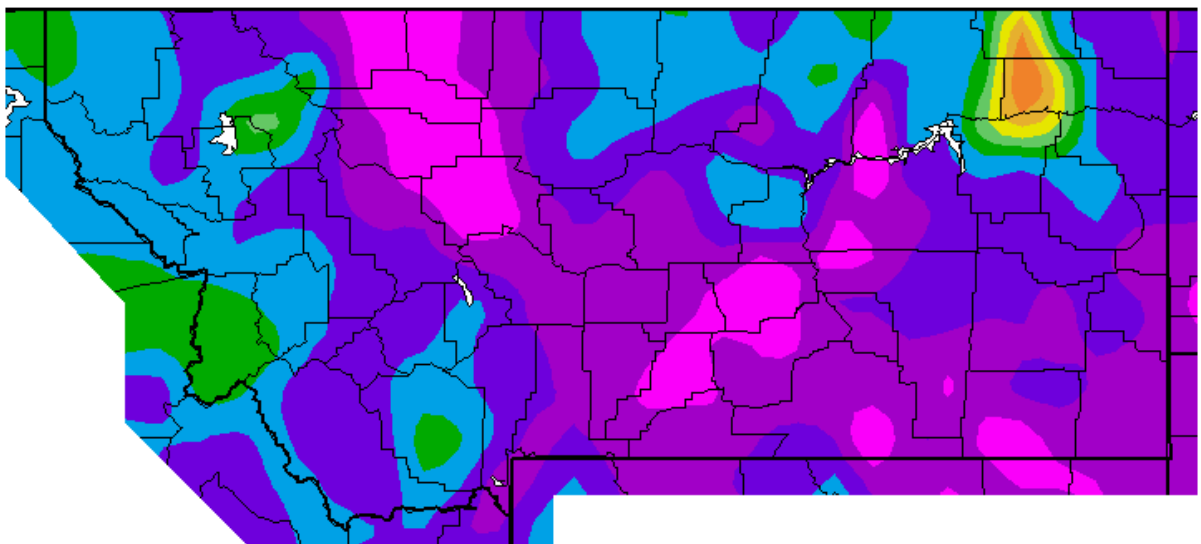


Figure 2. December 2016 temperature departures from normal (°F) (Western Region Climate Center).

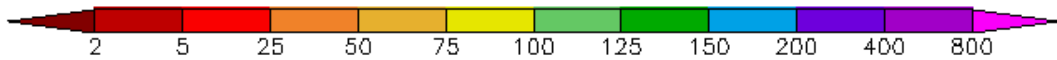
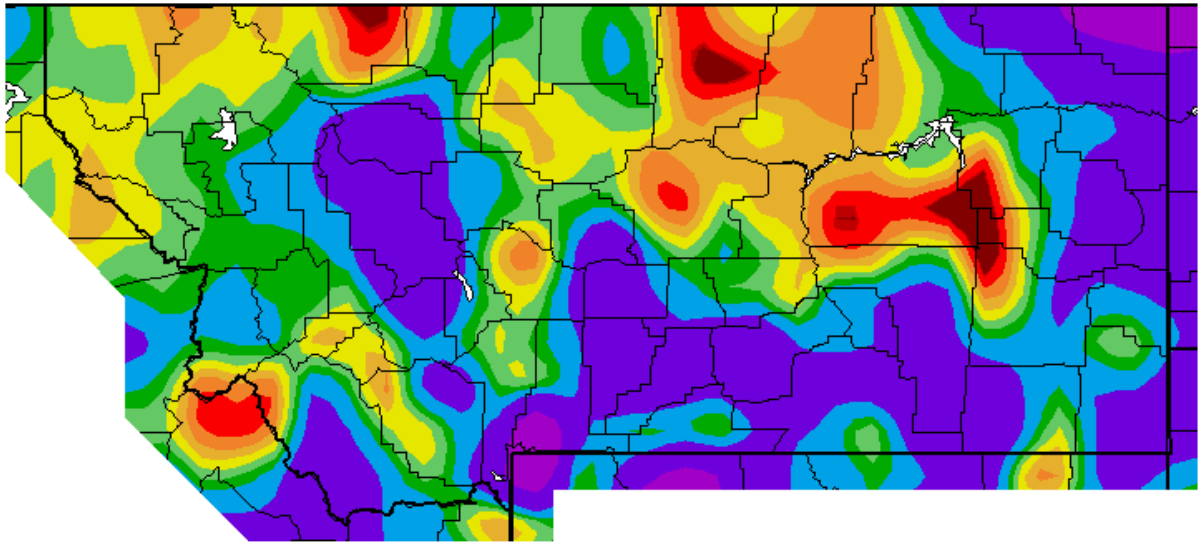


Figure 3. December 2016 precipitation departures from normal (percent) (Western Region Climate Center).

For a state map of % of normal water year precipitation (updated around the 7th of each month), go to:

<http://www.wrh.noaa.gov/tfx/climate/monthlysum/climatesum.php?wfo=tx>

For the latest information on mountain snowpack from the NRCS, go to: <http://www3.wcc.nrcs.usda.gov/snow/index.html>

For the latest U.S. Drought Monitor, issued weekly by the National Drought Mitigation Center, USDA and NOAA, go to: <http://droughtmonitor.unl.edu/>

These data are preliminary and have not undergone final QC by NEIC. Therefore, these data are subject to revision. Final and certified climate data can be access at the National Environmental Information Center (NEIC) <http://www.ncdc.noaa.gov>. Many more links are on the Drought Information Page of the NWS Great Falls web site at <http://www.wrh.noaa.gov/tfx/main/drought.php?wfo=tx>. The climatological record for normals is 1981-2010. The ranking period for temperature, precipitation and snowfall is since 1880. The ranking period for wind speeds is since 1936. The ranking period for soil moisture is since 1995.